

**U.S. FISH AND WILDLIFE SERVICE  
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Rorippa subumbellata*

COMMON NAME: Tahoe yellow cress

LEAD REGION: Region 8

INFORMATION CURRENT AS OF: April 2010

**STATUS/ACTION**

☐ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: December 27, 2000

☐ 90-day positive - FR date:

☐ 12-month warranted but precluded – December 27, 2004 (69 FR 77167)

☐ Did the petition request a reclassification of a listed species? No

**FOR PETITIONED CANDIDATE SPECIES:**

a. Is listing warranted (if yes, see summary of threats below)? Yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes

c. If the answer to a. and b. is “yes”, provide an explanation of why the action is precluded.

The Service designated *Rorippa subumbellata* as a category 1 candidate for listing on December 15, 1980 (45 FR 82479), indicating sufficient information on biological vulnerability and threats were available to support preparation of a listing proposal. In 1994-1995 we reviewed the need to propose *R. subumbellata* for listing. At that time, a regional drought led to a substantial drop in the level of Lake Tahoe, exposing large expanses of suitable habitat and the species colonized many of these areas. As a result of this response and changes to the Service’s method of categorizing candidate species, *R. subumbellata* was dropped from the list of Federal candidate species (61 FR 7462, February 28, 1996). Subsequent high water years and increased recreation within *R. subumbellata* habitats again reduced the number of occupied sites around the lake. Following an updated status assessment of *R. subumbellata* in which we found an increasing vulnerability to threats, we again included this taxon as a candidate species with a Listing Priority Number (LPN) of 2 (64 FR 57534, October 25, 1999).

We received a petition on December 27, 2000, to list *Rorippa subumbellata* as an endangered species under the Endangered Species Act based largely on the restricted distribution of the species, a declining trend in the numbers of sites and individuals observed, and the inadequacy of

existing regulatory mechanisms (League to Save Lake Tahoe and Center for Biological Diversity 2000). In our Candidate Notice of Review (CNOR) published on May 4, 2004 (69 FR 24876), we found that listing of *R. subumbellata* continued to be warranted but precluded by higher priority listing actions and maintained the LPN of 2. On June 21, 2004, the United States District Court for the District of Oregon (*Center for Biological Diversity v. Norton* Civ. No. 03-1111-AA) found that our resubmitted petition finding on *R. subumbellata* that we published in the CNOR dated May 4, 2004 (69 FR 24876), was not sufficient because we did not identify what the higher priority listing actions were, did not explain why these actions were of a higher priority, or why these higher priority listing actions precluded listing actions for *R. subumbellata*. The court ordered that we publish an updated finding for *R. subumbellata* within 180 days of the court order. On December 27, 2004 (69 FR 77167), we resubmitted a 12-month finding in which we concluded that a proposed rule to list *R. subumbellata* continued to be warranted but precluded by higher priority listing actions. We have considered the petition in this assessment and incorporated information from the petition where appropriate. A conservation strategy has been developed to address the threats to this species and coordinate management and conservation activities. Implementation of the strategy is currently underway and, if successful, is expected to preclude the need to list *R. subumbellata*.

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

☐ Listing priority change

Former LPN: ☐

New LPN: ☐

Date when the species first became a Candidate (as currently defined): October 25, 1999

☐ Candidate removal: Former LPN: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

☐ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

☐ F – Range is no longer a U.S. territory.

☐ I – Insufficient information exists on biological vulnerability and threats to support listing.

☐ M – Taxon mistakenly included in past notice of review.

☐ N – Taxon does not meet the Act's definition of "species."

☐ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering Plants, Brassicaceae (Mustard Family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Nevada and California

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Washoe, Carson, and Douglas Counties, Nevada, and El Dorado and Placer Counties, California

LAND OWNERSHIP: Populations occur on lands under management by a variety of agencies and entities, including the U.S. Forest Service (USFS) (27 percent); California Tahoe Conservancy (CTC), California Department of Parks and Recreation (CDPR), Nevada Division of State Parks (NDSP), and other county and city parks (31 percent); and private landowners (42 percent). These agencies and entities are described under Factor D. The actual acreage of sites varies with lake elevation.

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LEAD FIELD OFFICE CONTACT: Nevada Fish and Wildlife Office, Steve Caicco, (775) 861-6341, steve\_caicco@fws.gov

#### BIOLOGICAL INFORMATION

Species Description: *Rorippa subumbellata* is a member of the mustard family (Brassicaceae) known only from the shores of Lake Tahoe (Stuckey 1972, p. 297). The species is a decumbent, somewhat fleshy, herbaceous perennial that branches profusely. Leaves are generally oblong and deeply pinnately lobed. The inflorescences are umbel-like and elongate. Flowers are yellow and flowering occurs between late May and late October. Fruit and seed development is continuous during the flowering period, truncated by inundation or the first winter frost. Fruits are typically oblong and weakly inflated.



*Rorippa subumbellata*

J. Fraser, Service

**Taxonomy:** Numerous collections of *Rorippa subumbellata* were identified as *R. sinuata* or its synonyms until it was recognized as a distinct species restricted to the shores of Lake Tahoe by Rollins (1941, pp. 177-178; Stuckey 1972, pp. 296-297). The earliest collection of what was later to be known as *R. subumbellata* was by E.L. Greene sometime prior to 1891 (Stuckey 1972, p. 297). Rollins (1993, p. 767), in a treatment included in the latest version of the Jepson Manual, maintained *R. subumbellata* as a distinct species (Hickman 1993, p. 435). Current information on taxonomic validity was reviewed on the Jepson Flora Project website; *Rorippa subumbellata* is the accepted name for a taxon native to California (Jepson Online Interchange; <http://ucjeps.berkeley.edu/interchange.html>, accessed on March 31, 2010). We have carefully reviewed the available taxonomic information to conclude the species is a valid taxon.

**Habitat/Life History:** *Rorippa subumbellata* occurs on sandy substrates, in silty soils among boulders, along lake margins, near stream mouths, in organically enriched dune slacks, and in back-beach depressions in naturally dynamic environments (Knapp 1979a, p. 4; Ferreira 1987, p. 22; Pavlik *et al.* 2002, pp. 21-23). Physical processes such as wave action, lake level fluctuations, and the erosive forces of the wind heavily influence substrate characteristics. Soil moisture, an important determinant of plant species distribution, is strongly influenced by lake level (Ferreira 1987, pp. 67-80). Soil moisture also influences the colonization of *R. subumbellata* sites by other plant species that may compete with it for resources (Ferreira 1987, p. 81; California State Lands Commission (CSLC) 1998, pp. 32-33).

The presence and availability of suitable habitat for *Rorippa subumbellata* both correlate with lake level (Pavlik *et al.* 2002, pp. 42-46). The natural rim of Lake Tahoe is located at 6,223 feet

(ft) (1,897 meters (m)) mean sea level (msl) Lake Tahoe datum. A private timber crib dam constructed in 1870 at the Truckee River outflow from the lake was reconstructed between 1909 and 1913 to create 6.1 ft (1.8 m) of storage above the natural rim. The dam is operated according to the Truckee River Agreement to prevent the lake from exceeding 6,229.1 ft (1,898.6 m) msl (United States Department of Interior and State of California (USDI/CA) 2008, pp. 1-10).

In early January 1997, after a rain-on-snow event that caused extensive regional flooding, Lake Tahoe reached an elevation of 6,229.4 ft (1,898.6 m), the highest level since 1920. During an extended drought, such as occurred from 1989 to 1994, lake level can drop to or below the natural rim, exposing additional shoreline habitat (Pavlik *et al.* 2002, Table 8, p. 46). The lake level has dropped below its natural rim many times; the lowest lake level recorded occurred in 1992 when it reached 6,220.26 ft (1,632.61 m), or 2.74 ft (0.84 m) below its natural rim (CSLC 1998, p. 14).

During wet periods such as from 1995 to 2000, little potentially suitable habitat for *Rorippa subumbellata* is exposed (Pavlik *et al.* 2002, Table 8, p. 46). In 2000, the lake level began to fall as a result of drought conditions. Many previously inundated sites were exposed and resurveyed in 2001 through 2004 (CSLC 2002, p. 3, 2003, p. 19; Service 2004, p. 9; BMP Ecosciences 2005, p. 3). Lake level has been rising since 2005 and many of the lower elevation sites have become submerged again (BMP Ecosciences 2006, p. 4, 2007 pp. 8-9). The 2006-2007 snowpack was only about 50 percent of normal in the Truckee River Basin, but sufficient water was stored in Lake Tahoe to maintain the lake level above 6,225 ft (1,897 m) throughout the 2007 growing season. An intermediate lake level exposed some lower sites in 2008 that had been submerged for the previous two years. In 2009, the lake level was lower than in 2008, exposing more potential habitat for *R. subumbellata*.

Historical Range/Distribution: Range-wide surveys for *Rorippa subumbellata* populations were not conducted prior to 1979, thus information on the complete historical distribution of *R. subumbellata* is lacking. Survey efforts have been undertaken periodically since 1979 to determine range-wide distribution, status, and population trends of *R. subumbellata* (Knapp 1979a, pp. 1-10, 1979b, pp. 1-7, 1980, pp. 1-8; Ferreira 1987, pp. 1-336; Pavlik *et al.* 2002, pp. 23-24). As counting methods varied among surveyors, and seasonal timing of surveys was found to influence plant numbers observed, comparison of numbers of individual plants observed among years was not considered statistically valid until a standardized survey method was implemented in 2002 (Pavlik *et al.* 2002, p. A-45). Moreover, vegetative reproduction in this species prevents a count of the actual number of individuals; therefore, the aboveground portion of the plant (referred to as “stems”) is counted (CSLC 1998, p. 38; Pavlik *et al.* 2002, p. 18).

Data collected over the last 25 years indicate a relationship between lake level and site occupancy by *Rorippa subumbellata* (CSLC 2002, p. 3, 2003, p. 19; Pavlik *et al.* 2002, pp. 42-46; Service 2004, p. 9). The data generally show that species presence fluctuates yearly in response to lake level which determines the amount of exposed habitat. When the lake level is high, many sites are inundated and unavailable for that year's plant growth; when the lake level is low, more habitat is exposed and available for colonization. Records kept since 1900 show seven high-level peaks encompassing 53 years, including 29 years in which the legal lake elevation limit was exceeded (Pavlik *et al.* 2002, p. 11), although levels greater than the legal

limit have not occurred for any significant length of time (CSLC 1998, p. 14). In comparison, there were about five low-level troughs comprised of 32 years, with only 21 years that were at or below the lake's natural rim (Pavlik *et al.* 2002, p. 11). These data indicate a preponderance of years with high lake levels that act to reduce the number of *R. subumbellata* populations and isolate them to higher beach elevations (Pavlik *et al.* 2002, p. 11). Low lake level years, more favorable to the species, have occurred less than half as often as less favorable high lake level years (Pavlik *et al.* 2002, p. 11).

In 1993, a low-water year when lake elevation averaged 6,223 ft (1,897 m), plants were documented at 30 general locations, the largest number of occurrences ever documented in 1 year (CSLC 1998, p. 29). During higher lake levels in subsequent years, the number of occupied sites declined, although not entirely in response to habitat inundation since some populations were absent from higher elevation sites that were not inundated. In 1995, only 8 of the 30 generalized locations known from 1993 were occupied (CSLC 1998, p. 29). Lake-wide surveys were not conducted in 1996, but *Rorippa subumbellata* was present at five sites considered most likely to support plants (CSLC 1998, p. 29). Between 1997 and 2000 the species was present at only 8 to 14 of an average of 38 sites surveyed each year during this period of high lake levels (Pavlik *et al.* 2002, Appendix D).

Lake levels began to recede in 1999, and by 2001 the lake elevation was near the natural rim, exposing hundreds of acres of habitat. In 2001, *Rorippa subumbellata* was present at 31 of 58 sites surveyed, up from 14 occupied sites the previous year; 7 of the sites at which the species was observed are located in areas that had been submerged during annual surveys dating back to 1997 (CSLC 2002, p. 3). Following the 2001 annual surveys, data collected between 1979 and 2001 were analyzed to determine if there was a relationship between the number of sites surveyed and the number of sites where *R. subumbellata* was observed, and to compare the presence of the species between low and high lake elevation years (CSLC 2002, Appendix B). The analysis showed a statistically significant ( $P$  less than 0.01) relationship between the number of sites surveyed, particularly in low lake elevation years, and the probability of observing *R. subumbellata*. The results also demonstrated a statistically significant negative relationship between high lake elevations and the presence of *R. subumbellata* over the period of analysis, a finding consistent with those reported by Pavlik *et al.* (2002, p. 42). In 2002, when the lowest lake levels since 1994 were recorded, survey efforts were intensified; an estimated 20,301 "individuals" of *R. subumbellata* were present at 48 of the 71 sites surveyed (CSLC 2003, p. 5). Lake levels remained low in 2003 and 2004, when plants were present at 45 of 69 sites surveyed and 47 of 64 sites surveyed, respectively (Service 2004, p. 4; BMP Ecosciences 2005, p. 3).

The lake level was nearly 2.0 ft (0.6 m) higher during the 2005 survey and many areas exposed in previous years were submerged at the time of the surveys. *Rorippa subumbellata* plants were present at 47 of 62 sites surveyed (BMP Ecosciences 2006, p. 4). In 2006, the lake level was 3 ft higher than the previous year and plant were present at only 24 of 62 sites surveyed (BMP Ecosciences 2007, p. 8). The lake level dropped to the 2005 level in 2007 and continued to fall in 2008 when it was at an elevation of 6224 ft (1897 m) during the survey period. As a consequence, *R. subumbellata* was present at 30 of 61 sites surveyed in 2007 and at 43 of 61 sites surveyed in 2008 (BMP Ecosciences 2009, p. 10).

Current Range/Distribution: The general distribution of *Rorippa subumbellata* at Lake Tahoe is shown in Figure A. The current range of the species, however, has to be evaluated within the context of our current understanding of its metapopulation dynamics (Pavlik *et al.*, 2002, pp. 27-37). Its persistence over time is due to a population dynamic in which local extirpation is countered by colonization (Pavlik *et al.* 2002, p. 27); new, unoccupied sites can be colonized and old occupied sites can be extirpated or recolonized. The probability of colonization or recolonization is determined by attributes of the species (propagule longevity and mobility), of the site (location, physiography, microclimate, biological community), and by the nature of the migration path (dispersal agents, complexity) (Pavlik *et al.*, 2002, p. 27). The probability of extirpation is determined by plant attributes (propagule longevity in situ, plant survivorship and reproductive output, stress tolerance), and site attributes (disturbance regime, habitat abundance and quality). Given the complexity of this metapopulation dynamic, the unpredictability of where colonization and extirpation will occur, and the close relationship between populations and lake level, the entire shoreline and adjacent beach and back beach habitats of Lake Tahoe, as well as the mouths of streams that flow into Lake Tahoe must be considered within the current range and distribution of the species. Within this range, potentially suitable habitat has been defined, until further refined, as any parcel identified as containing 30 percent sand in a Tahoe Regional Planning Agency (TRPA) 1993-1994 shorezone study (Pavlik *et al* 2002, p. 65).



Figure A. *Rorippa subumbellata* sites at Lake Tahoe (Pavlik *et al.* 2002, p. 13); lake shown in gray, black line is watershed boundary.

Population Estimates/Status: As stated above, the lake elevation was low between 2001 and 2005, which exposed extensive available habitat along the shorezone for *Rorippa subumbellata*



to colonize. The low lake elevations coupled with increased search efforts resulted in the greatest number of occupied sites observed since the inception of lake-wide surveys. Over time, the number of stems at each site has ranged from one into the thousands. While some sites consistently support hundreds of stems, depending upon lake level, many sites typically support very few plants. Approximately 25,200 stems were counted or estimated at 45 sites in 2003, whereas during the 2000 annual survey when lake levels were high, the total estimated number of stems was 4,590 at 15 sites. These data demonstrate the natural fluctuations in the number of individual stems of *R. subumbellata* populations are a function, in part, of lake elevation and available habitat (Pavlik *et al.* 2002, p. 49). To reduce work effort, the counting methodology was changed in 2004, when all plants within 6 inches (15 centimeters) of any other plant were considered to be one individual. This resulted in a total number of fewer individuals at most sites. This change proved unworkable in practice was discontinued for the 2005 surveys. In 2005, the stem count was 25,384 (BMP Ecosciences 2006, p. 9) which, despite the higher lake level, is likely a function of many different factors (BMP Ecosciences 2006, p. 12). It may be that transitional years (when the lake is moving from lower to higher levels, or vice versa, provide the optimal conditions for *R. subumbellata* presence, or that there is some threshold of lake level below which the number of occupied sites declines markedly (BMP Ecosciences 2006, p. 12). Stem counts were again reduced in 2006 at only 4,560, roughly comparable to the number in 2000 (BMP Ecosciences 2007, p. 12). Consecutive years of lower lake levels in 2007 and 2008 resulted in estimates of 11,847 stems at 30 sites and 17,125 stems at 43 sites, respectively (BMP Ecosciences, 2009, pp. 13, 22-23). Lake levels were very low in 2009 and plants were found at 47 sites, which equaled the greatest number of occupied sites recorded in any year. The estimated stem count in 2009 was 27,522 (BMP Ecosciences 2010, p. 24). Based on the data discussed above, we conclude that the number of occupied sites and the total stem count varies predictably in response to lake elevation, a pattern that will likely continue if suitable habitats remain available for colonization and threats are controlled.

## THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range. *Rorippa subumbellata* occurs in a dynamic environment influenced by both natural processes and human activities. Habitat occurrence and suitability are shaped by physical processes such as fluctuations in lake elevation, wave-induced beach erosion, or changes in stream channel orientation, all of which may eliminate or create suitable substrates for plant growth (CSLC 1998, p. 32; Pavlik *et al.* 2002, pp. 20-23). Substrate moisture also influences the occurrence of *R. subumbellata*, as well as competition with other plant species for space, light, nutrients, and other plant requirements (Ferreira 1987, pp. 31-35). Under natural conditions, *R. subumbellata* is apparently tolerant of the dynamic nature of its habitat and adapted for survival in a disturbance regime. However, the habitat conditions are now determined in part by management of the lake level for water supply purposes (CSLC 1998, p. 32).

Most *Rorippa subumbellata* sites are used for commercial and public purposes and are affected directly and cumulatively by various activities such as recreation, erosion control, marina developments, and pier construction (CSLC 1998, pp. 32-33; Pavlik *et al.* 2002, pp. 42-43). Recreational use of the public beaches at Lake Tahoe constitutes the greatest threat to *R. subumbellata* and its habitat. Many public beaches, which support the largest occurrences of the



species, are filled to capacity during the summer months, and heavy recreational use results in compaction and mixing of sandy substrates and destruction of the armor layer (CSLC 1998, p. 34). Major colonies of *R. subumbellata* occurring on beaches managed by public agencies have persisted over time because of management actions taken by these agencies (see Factor D, Inadequacy of Existing Regulatory Mechanisms). However, because the continued existence of this species is dependent upon a metapopulation dynamic, it is essential that occupied and suitable sites on both public and private lands be protected (Pavlik *et al.* 2002, pp. 62-64, 73-75, 92-94).

Prospects for continued survival of *Rorippa subumbellata* on high-use beaches have been evaluated by examining available information on past and present recreational use of Lake Tahoe's public beaches for indications of future trends. Sites occupied by *R. subumbellata* differ greatly in their level of recreational visitation. Visitation at five Nevada State Parks ranges between 750,000 and 1 million visitors per year (1989-2000), with similar levels at California State Parks and USFS lands in the basin (Pavlik *et al.* 2002, p. 42). Data are not available for privately owned sites, but presumably the level of use is substantially lower than on publicly managed sites. Activities that encourage foot traffic along heavily visited beaches have the most deleterious impacts on *R. subumbellata* and its habitat (Pavlik *et al.* 2002, p. 42). Demands for beach recreation are expected to increase as a result of urban population growth in Nevada and on the western slope of the Sierra Nevada. Resource managers have observed upward trends in day use in the Lake Tahoe Basin and predict that use will increase over time.

Human-created disturbances in the shorezone of Lake Tahoe also contribute to the loss and degradation of *Rorippa subumbellata* and its habitat. Structures that extend into the water, such as boat launches, piers, and marinas, are a possible deterrent to the natural transport of sand along the shoreline, which may decrease beach habitat; in addition, new construction and the ongoing maintenance of these structures also poses a direct threat to the habitat of the species (CSLC 1998, p. 33; Pavlik *et al.* 2002, p. 11). Lakeshore structures may also affect propagule transport which is important to the colonization of new sites and the recolonization of extirpated sites.

Approximately 42 percent of the populations of *Rorippa subumbellata* that have been monitored over time occur on privately owned beaches, which in California are overlain by a public trust easement that permits beach use by the public where access is available. Much of the habitat on the private land sites is in good condition. However, some of these beaches are used for boat storage and are periodically raked by the property owners to provide a uniform surface for recreational activities; in the process, larger pebbles, cobbles, and boulders and organic materials are removed. This practice may directly uproot seedlings and adult plants or indirectly degrade the habitat by altering substrate structure and moisture-holding capacity, both important habitat characteristics for *R. subumbellata* (CSLC 1998, pp. 33-34; Pavlik *et al.* 2002, p. 11).

Although *Rorippa subumbellata* appears well adapted to its dynamic shorezone environment and is capable of recolonizing sites after periods of inundation, the threat of human activities identified above remain during both high and low lake levels. Proposals for construction of new piers and pier extensions, marina expansions, and revetment repairs and replacements are continuously being submitted to permitting agencies (Mike Vollmer, TRPA, pers. comm. 2004).

Future losses or degradation of potential habitat may greatly affect the metapopulation dynamic upon which this species relies for its continued survival (Pavlik *et al.* 2002, p. 29).

#### Summary of Factor A

*Rorippa subumbellata* faces a significant threat to its continued existence primarily from human trampling on the heavily used public beaches. On private beaches, which tend to be less heavily used, trampling is a lesser threat, but these beaches are often raked, which can uproot seedlings and adult plants, and are used for boat storage which may impact habitat. A long-term threat to the viability of the species is posed by the construction of piers, boat launches, and marinas which reduces or eliminates habitat and may interfere with the process of sand transport and lead to the erosion of the beach habitat on which the species depends, and may also affect propagule transport which is critical to the colonization of new sites and recolonization of extirpated sites. Ongoing maintenance of existing structures may also impact the species and its habitat.

B. Overutilization for commercial, recreational, scientific, or educational purposes. There is no evidence of threats from commercial, recreational, scientific, or educational overutilization.

C. Disease or predation. There are no known threats from disease or predation.

D. The inadequacy of existing regulatory mechanisms. Activities in the Lake Tahoe Basin, including use within the shorezone, on both public and private lands, are regulated under various agency policies and management directions, many of which include provisions for protection of *Rorippa subumbellata*. However, despite the myriad of potential protective mechanisms, current regulatory protection alone is not adequate.

*Rorippa subumbellata* is listed as an endangered species under the California Endangered Species Act (CESA). State agencies are required to consult with the California Department of Fish and Game (CDFG) to determine whether projects under their purview would jeopardize the continued existence of any listed species. If detrimental effects on the species are likely to occur, CDFG is responsible for developing project alternatives consistent with conservation of the species. However, State law requires only that the landowner notify the agency at least 10 days in advance of changing the land use to allow salvage of State-listed plants.

*Rorippa subumbellata* is also designated as a critically endangered species by the State of Nevada, and under Nevada Revised Statutes 527.270 *et seq.*, the species may not be removed or destroyed except under special permit issued by the Nevada Division of Forestry (NDF). In the course of issuing permits, efforts are typically made to minimize or eliminate deleterious effects on State-listed species through project modifications. The adequacy of this law depends on informed and cooperative landowners, or on deterrent enforcement. However, there are no State protocols in place informing landowners of the presence of critically endangered species on their lands, and deterrent enforcement does not currently exist.

The Tahoe Regional Planning Compact of 1969 (Public Law 96-551), as revised, established the TRPA, a bi-State entity authorized to develop environmental threshold carrying capacities for the Lake Tahoe Basin, which are to be achieved through the development of a regional plan and

implementing ordinances. All applications for shorezone development are reviewed by TRPA to ensure that *Rorippa subumbellata* populations and habitats are not disturbed. Shorezone activities regulated by TRPA include construction of new structures (piers, jetties, breakwaters, boat ramps, boat houses, fences, buoys, shoreline protective structures, and marinas); modifications (major structural repair, reconfiguration, and expansions) and other activities, including salvage operations, tour boat operations, waterborne transit, and seaplane operations. A Final Environmental Impact Statement on TRPA's proposed shorezone program was released in November 2006 (TRPA 2006, pp. 1-4). Amended ordinances were adopted on October 26, 2008, and took effect on December 22, 2008; the new ordinances allow an additional 138 piers, 1,862 buoys, 6 ramps, and 235 slips to be constructed by 2027 (TRPA 2008a, pp. 2-3). The specific locations at which these structures might be permitted to be built is unknown, so it is not possible to assess their potential effects on *R. subumbellata*. Section 75.2.A of the amended code states: "Projects and activities in the vicinity of sensitive plants and their associated habitat, shall be regulated to preserve sensitive plants and their habitat. All projects or activities that are likely to harm, destroy, or otherwise jeopardize sensitive plants or their habitat, shall fully mitigate their significant adverse effects. Those projects and activities that cannot fully mitigate their significant adverse effects are prohibited. Measures to protect sensitive plants and their habitat include, but are not limited to: 1) fencing to enclose individual populations or habitat; 2) restriction on access or intensity of use; 3) modifications to project design as necessary to avoid adverse impacts; 4) dedication of open space to include entire areas of suitable habitat; or 5) restoration of disturbed habitat (TRPA 2008b, pp. 75-1, 75-2)." The TRPA also has developed beach-raking guidelines, which discourage beach raking within known habitats of *R. subumbellata* (University of Nevada Cooperative Extension 2002, p. 64). The effectiveness of these ordinances and guidelines in protecting and conserving *R. subumbellata* on the private lands on which 42 percent of the known sites occur has not been established.

*Rorippa subumbellata* is included on the list of USFS sensitive species. The USFS, which manages about 27 percent of the known sites, develops and implements management practices that ensure species do not become threatened or endangered as a result of their actions. Management activities for *R. subumbellata* on USFS lands have included annual surveys, construction of enclosures around major occurrences, and transplanting programs. The commitment to such programs by the USFS is dependent upon annual staffing and other priorities in the Lake Tahoe Basin, but these programs have been very successful over the past several years. Projects have included the construction of a number of enclosures to protect the species and placement of informative signs on the enclosures and elsewhere to educate the public. Other public agencies with similar management programs include the CTC, CDPR, and NDSP.

The CDPR is also required, under CEQA and CESA, to manage populations of *Rorippa subumbellata* on California State Park lands so as to ensure that their actions do not jeopardize the species. Ongoing management for *R. subumbellata* at Emerald Bay and D. L. Bliss State Parks includes annual monitoring of all populations and habitats. Past efforts have included reestablishment of an extirpated population on Lester Beach at D.L. Bliss State Park through a program of outplanting, fencing, and monitoring.

The CSLC administers the State's fee ownership to the bed of Lake Tahoe from 6,223 ft (1,897 m) elevation lakeward and a public trust easement between 6,223 ft (1,897 m) and 6,228.75 ft (1,898.52 m) elevation. Public and private entities must apply to CSLC for permits to construct marinas and other structures on State lands or waters. In consultation with CDFG, CSLC provides review under the CEQA and CESA for discretionary projects in the shorezone and requires mitigation for all projects under their jurisdiction. Again, CESA does not ensure the continued survival of individual populations.

Land management and regulatory agencies in the Lake Tahoe Basin have collaborated in the development and implementation of a conservation strategy for *Rorippa subumbellata* since a Memorandum of Understanding was signed in January 2003. To date, the conservation strategy has been highly effective in addressing key management questions related to understanding the biology of the species, including propagation, transplantation, and translocation techniques. These studies have largely been conducted within temporary exclosures. Now that the research objectives are nearly met most temporary exclosures will be removed. The USFS installs and removes protective fencing for populations on beaches they manage on an annual basis but protection of occupied and potentially suitable habitat has proven challenging in general. This is due to the inherent difficulty and cost associated with controlling impacts from beach recreation short of closing portions of public beaches and resistance to beach closure from public land recreation staff. Moreover, enhancement of existing populations or reintroduction of the species into former or potential habitat is not likely to be supported because of the potential to impact beach recreational opportunities.

The NatureServe network includes Natural Heritage Programs that operate throughout the United States, as well as in Canada, Latin America, and the Caribbean. Natural Heritage rankings reflect the rarity and vulnerability of species on a global (G-rank) and a state scale (S-rank). These ranks are based on a scale of 1 to 5, with 5 indicating a species is widespread and secure and 1 indicating a species is imperiled. *Rorippa subumbellata* is currently ranked G1, S1 (in both California and Nevada). While this ranking has no regulatory implications, it provides resource managers the ability to objectively track sensitive species that may occur on lands under their purview.

#### Summary of Factor D

While the States of California and Nevada provides some regulatory protection through their endangered species statutes to *Rorippa subumbellata*, these laws serve more to minimize impacts to the plant on private land than to avoid them. The USFS and various agencies in each State have management programs for *R. subumbellata* and its habitat on lands under their management. Impacts from beach recreation, however, are difficult to control short of beach closures which are unlikely due to resistance from agency recreation staffs who also do not support plant population enhancement or reintroductions due to the potential to impact recreation on public beaches. The TRPA has the most protective ordinance with respect to development impacts to *R. subumbellata* and its habitat, but the effectiveness of this ordinance in protecting plants on private land has not been established. Moreover, some activities that may impact the species or its habitat, such as beach raking and boat storage, are not regulated. At this time, we have insufficient information to evaluate the significance of the threat posed by the inadequate

regulatory mechanisms.

E. Other natural or manmade factors affecting its continued existence. Lake level fluctuations between elevations of approximately 6,223 and 6,229 ft (1,897 and 1,899 m) result from operation of the Lake Tahoe Dam at the outlet of Lake Tahoe at Tahoe City, California. The dam is owned by the U.S. Bureau of Reclamation; the Federal Water Master in Reno, Nevada, is responsible for coordinating the operation of Truckee River reservoirs, including the Lake Tahoe Dam, to satisfy Orr Ditch Decree water rights, maintain minimum releases, and comply with flood control and dam safety requirements (USDI/CA 2004, pp. 3-41 to 3-44). Releases from the dam are in accordance with procedures negotiated in the Truckee River Agreement, which provides releases to meet downstream demands. Holding lake surface elevations at high levels during the growing season may increase competition by species which are adapted to higher soil moisture than *Rorippa subumbellata* in inundated suitable habitats for the species (Ferreira 1987, p. 81) and concentrates recreational use in the upslope habitats of the plant (Pavlik *et al.* 2002, p. 11).

In periods of drought, the lake may drop below its natural rim of 6,223 ft (1,897 m) elevation for extended periods. Recolonization of exposed areas after inundation has been documented in several instances (Ferreira 1987, p. 81; Pavlik *et al.* 2002, pp. 33-34). During the drought of the late 1980's and early 1990's, lake elevations remained at or below the natural rim and many newly exposed shoreline habitats were colonized by *Rorippa subumbellata* (CSLC 1998, pp. [REDACTED]). The duration of inundation of the low- and mid-elevation sites was most extensive during the 1990's. The region experienced relatively dry winters between 1999 and 2002, and lake elevations dropped to near the natural rim, exposing previously inundated known and potentially suitable habitat. Many of these sites were colonized during the 2001, 2002, and 2003 seasons (CSLC 2002, p. 3; 2003, p. 5; Service 2004, p. 9).

A Federal action to modify operations of the Truckee River reservoirs through implementation of the Truckee River Operating Agreement (TROA) has been negotiated by the Secretary of the Interior in accordance with subsection 205(a) of the Truckee-Carson-Pyramid Lake Water Rights Settlement Act (Public Law 101-618). An analysis of potential effects by implementation of TROA has been completed, including an analysis of potential changes in the level of Lake Tahoe and possible effects on *Rorippa subumbellata*. The analysis shows that implementation of TROA would result in a growing season average of 1 percent more habitat available under dry hydrologic conditions when compared to current conditions or no action, 1 to 2 percent less habitat under median hydrologic conditions during August and September when compared to no action or current conditions, and no change in available habitat during wet hydrologic conditions when compared to no action or current conditions. On average, 6 fewer acres (2.4 ha) of habitat would be available under median hydrologic conditions; this is a difference of less than 1 percent of the total potential habitat. The effects of TROA implementation were deemed to not be significant under both the National Environmental Policy Act and CEQA (USDOI/CA 2008, pp. 3-284 to 3-291). A final federal rule was promulgated and took effect on January 5, 2009 (73 FR 74031; December 5, 2008); actual implementation of the TROA, however, cannot take place until several contingent actions are completed.

## CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The CSLC and TRPA, in conjunction with various other Federal, State, and local partners, developed a stewardship plan which was intended to provide protection for *Rorippa subumbellata* so that shorezone development would not be detrimental to species survival. Funds for this plan were to be derived from mitigation fees assessed on permitted development projects located within the shorezone. The effort to develop the plan and fund its implementation was underway for a period of years, and various versions of a draft plan were produced; however, acquisition of funds to complete the plan, begin implementation, and identify management actions to protect the plant was never realized.

In 1997, CSLC formed a multi-agency survey team to perform annual lakeshore-wide surveys to determine the presence or absence of *Rorippa subumbellata*. Agencies involved in the effort contribute various in-kind services (watercraft, Global Positioning System (GPS) units, aerial photographs, etc.) or post-survey data compilation (Pavlik *et al.* 2002, pp. 5-7). These surveys are ongoing and the data collected continue to be refined so as to inform management decisions and conservation efforts.

The USFS, CTC, and CDPR have management programs for *Rorippa subumbellata*, which include monitoring, fenced enclosures, and transplanting efforts when funds and staff are available. Also, TRPA has developed beach-raking guidelines, which discourage beach raking within known habitats of *R. subumbellata*. TRPA's regulation of shorezone activities is intended to ensure that projects on all lands requiring permits do not have deleterious impacts on *R. subumbellata* and its habitat.

Because the Service elevated *Rorippa subumbellata* to candidate status, a technical advisory group, which is comprised of public agencies (including the Service), private landowners, and environmental groups, was convened in 1999 to develop a conservation strategy coupled with a Memorandum of Understanding-Conservation Agreement (Pavlik *et al.* 2002). Through the participation of academicians and scientists with expertise in rare plant conservation, this effort combined all of the data previously collected on *R. subumbellata* through the 2000 annual survey. This information was translated into goals and objectives for the strategy, and a research and monitoring agenda, and serves as the foundation for an adaptive management program. The strategy and agreement were completed and signed by the TRPA, Service, USFS, NDSP, NDSL, NDF, Nevada Natural Heritage Program, CDFG, CDPR, CTC, CSLC, League to Save Lake Tahoe, and the Tahoe Lakefront Owners Association in January 2003. Parties to the strategy and agreement share responsibility in funding research and conservation activities, organizing and facilitating meetings, and participating in annual survey efforts. Funding has been secured in recent years through the Service, Bureau of Reclamation, and the Southern Nevada Public Lands Management Act, as well as appropriated money to various Federal, State, and local agencies. Critical to the success of the conservation strategy is voluntary stewardship of private beaches on the lakefront; a stewardship program is currently in the early stages of development.

The conservation strategy identifies six primary goals: 1) Protect occupied habitat and potentially suitable habitat that does/could support natural populations; 2) Improve *R. subumbellata* populations; 3) Promote conditions that favor a positive metapopulation dynamic; 4) Conduct research that directly supports management and restoration; 5) Revise and continue

the monitoring program for *R. subumbellata*; and, 6) Implement an interagency adaptive management framework. The last three of these goals have largely been successfully implemented. In addition, several *R. subumbellata* populations have been improved and a new population has likely been established through the research program (Goal 2). Goal 3 has not been achieved because limitations on access to private land have precluded the random survey previously thought necessary to assess the metapopulation dynamic. An alternative approach to establishing the metapopulation dynamic, using genetic markers, has been proposed and will be submitted for funding through the 2010 Request for Proposals for the Service's Section 6 grant process (Peacock 2010). Goal 1 remains elusive for reasons discussed above under Factor D.

Other recent accomplishments under the conservation strategy include: the production and distribution of a tri-fold brochure designed to educate the public about *R. subumbellata* conservation; completion of research studies to answer questions about the optimal time to plant container-grown plants and whether outplants of container-grown plants and translocation of naturally-occurring plants have similar success rates; and the launch of a website for public outreach ([www.tahoeyellowcress.org](http://www.tahoeyellowcress.org)) (BMP Ecosciences 2010, p. 26). In addition, a detection probability assessment was conducted comparing detection rates while walking on the beach to detection rates while walking or floating in a kayak at the water's edge (BMP Ecosciences 2010, pp. 5-6). Finally, over 2,000 leaf samples were collected from 51 sites for future genetic analysis to assess the metapopulation dynamics of the species (BMP Ecosciences 2010, p. 25). If successfully and fully implemented, this strategy and associated agreement will preclude the need for the Service to list the species. The conservation strategy and agreement are available online at [http://www.fws.gov/nevada/protected\\_species/plants/documents/tyc\\_cs\\_trpa2002.pdf](http://www.fws.gov/nevada/protected_species/plants/documents/tyc_cs_trpa2002.pdf).

#### SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate)

The primary threat to *Rorippa subumbellata* is recreational activities on the public beaches and adjacent habitats around the shore of Lake Tahoe. Although the amount of available habitat varies with lake level, the amount of water that can be stored is greatly influenced by snowpack. Periods of low precipitation have regularly caused the lake level to drop, even below the natural lake rim during extended droughts, and the management of stored water behind Lake Tahoe Dam is not considered to pose a significant threat to the species at this time. Less significant than recreational activities but, nevertheless, real threats are posed by shorezone development and maintenance activities on private lands. A conservation strategy has been developed and is being implemented to address the threats to *R. subumbellata*. Numerous Federal, State, and local agencies have signed an agreement and are actively involved in its implementation. An annual monitoring plan is in place, and research is being conducted on the genetics and population dynamics of the species, as well as propagation protocols and transplantation approaches. At this time, methods have been identified to mitigate many threats but, until the protocols have been developed to mitigate losses from individual projects through population enhancement or establishment of new populations, the removal of this species from candidacy is premature. In addition, many core populations occur on private land and a planned voluntary stewardship program has yet to be implemented. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.



For species that are being removed from candidate status:

\_\_\_ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

## RECOMMENDED CONSERVATION MEASURES

Continued implementation of the conservation strategy, including the private land stewardship program, and research and monitoring program, is recommended at this time. In particular, methods for population enhancement and new population establishment should be a high priority.

## LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
<b>Moderate to Low</b>	<b>Imminent</b>	Monotypic genus	7
		<b>Species</b>	<b>8*</b>
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

*Magnitude:* Despite the relatively high number of populations observed during the recent low lake level surveys, we still have concern over increasing and intense recreational use and further development of the shorezone at Lake Tahoe. However, because of the continued commitments to conservation demonstrated by regulatory and land management agencies participating in the conservation strategy, the magnitude of threats has changed from high to moderate. The Tahoe Lakefront Owners Association has played a supportive role in educating and engaging private landowners around the Lake Tahoe Basin regarding the importance of conserving this endemic species. While regulatory agencies that oversee activities in the basin continuously receive permit applications for the construction, repair, and maintenance of boat launches, piers, and revetments, and other development that alters the shorezone, integration of the terms of the

conservation strategy into permit requirements is expected to increase awareness and protection for the species. Successful implementation of the conservation strategy is necessary to keep the threats from recreation and development in check and allow the Service to reassess the LPN for *Rorippa subumbellata*. Efforts to minimize or eliminate impacts to this species and its habitat are ongoing through implementation of this conservation strategy. In the future, if we determine the ongoing management and conservation activities have adequately reduced or eliminated the threats to the species, the removal of *R. subumbellata* as a candidate species will be considered.

*Imminence:* Threats to *Rorippa subumbellata* from various land uses such as recreational activities are currently ongoing, particularly because of the high lake levels since 2005 which concentrates recreational use in exposed high beach habitat; the threats are, therefore, imminent. The lake level continued to drop in the summer of 2009, thereby exposing more habitat that has been present over the past few years. Current projections for the summer of 2009 are that the lake level may stabilize but is not likely to rise substantially due to the preceding drought years. While this leads to less concentrated recreational activity, the level of such activity remains sufficiently high to constitute an imminent threat to *Rorippa subumbellata*.

Rationale for Change in Listing Priority Number (insert if appropriate)

\_\_\_\_ Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed? Yes

Is Emergency Listing Warranted? No. As previously discussed, the development and ongoing implementation of the Conservation Strategy for Tahoe Yellow Cress (*Rorippa subumbellata*) (Pavlik *et al.* 2002) has demonstrated a commitment among regulatory and land management agencies and private landowners to actively protect this species into future. Successful long-term implementation of the conservation strategy is expected to preclude the need to list the species under the Act.

## DESCRIPTION OF MONITORING

Various surveys and studies of *Rorippa subumbellata* have been conducted on the beaches around Lake Tahoe since 1979. Many historical locations of *R. subumbellata* have been well documented, providing long-term presence-absence data for the region (Baad 1978, 1979; Knapp 1979, 1980; Reed 1982; Ferreira 1987, 1988; CSLC 1994, 1998, 2002, 2003; Service 2004; BMP Ecosciences 2005, 2006, 2007, 2008, 2009). However, inconsistencies in survey methods over the years (non-consecutive survey years, incomplete surveys, and variable sampling methodology) have made direct comparisons of data difficult. Also, the naming convention of the sites has been at issue over the years. Therefore, an effort was made prior to the 2003 survey to reconcile site names with previous year's data. As a result, some sites were combined and some were separated based on the presence of protective enclosures.

As part of the conservation strategy, a protocol was developed and implemented that includes a census of known populations and systematic searches of areas supporting unoccupied, potentially suitable habitat (Pavlik *et al.* 2002). Beginning in 2001, the annual survey was designed to

expand on previous efforts through the collection of data on habitat variables that will assist in elucidating the distribution patterns and abundance of *Rorippa subumbellata*. The annual survey includes collection of information on occurrence size, number of stems, and other habitat characteristics.

The annual lake-wide survey for *Rorippa subumbellata* is consistently conducted during the week following Labor Day in early September. Participants typically include staff from the TRPA, Service, USFS, NDSP, NDF, CDFG, CDPR, CTC and the CSLC. Participants are divided into teams that survey the known, historical, and potential habitat sites by covering the entire width of the beach, from waters edge to the high water line. Land use (type and disturbance) and search effort are recorded at both occupied and unoccupied sites. Search effort is defined as the amount of person minutes spent actively searching for and collecting data on *R. subumbellata*. Site boundaries are delineated using GPS technology and are generally defined either by natural (river mouth or substrate change) or artificial features that restrict the surveyor's movement around the lakeshore (changes in ownership, jetties, and fences).

For sites supporting *Rorippa subumbellata*, surveyors estimate general habitat parameters across the entire site, with GPS data obtained for each "cluster" of plants within the site boundaries. To better characterize the occupied habitat, the physical and biological attributes are recorded for each individual cluster. A cluster is defined as a group of plants that occur within 21 ft (6.5 m) diameter of each other. This distance equates to the resolution capability for point data using handheld GPS units. Information specific to each cluster is also collected including the actual or estimated number plants, actual or estimated of plants in each phenological stage, and minimum and maximum rosette diameter. Additional physical and biological attributes are recorded for each cluster including slope, distance to lake, substrate/soil cover, and percent cover of associated plant species. These data are compiled and maintained by the Nevada Natural Heritage Program.

## COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: California

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Indicate which State(s) did not provide any information or comments: Nevada

## LITERATURE CITED

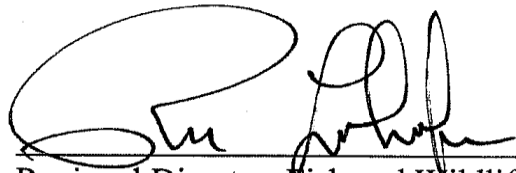
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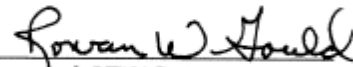
APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

  
Regional Director, Fish and Wildlife Service

Date 6-7-2010

Concur:

  
ACTING  
Director, Fish and Wildlife Service

Date: October 22, 2010

Do not concur:

\_\_\_\_\_  
Director, Fish and Wildlife Service

Date

Director's Remarks:

Date of annual review: April 2010

Conducted by: Steve Caicco

FY 2010, R8 CNOR: Tahoe yellow cress